Appendix D. Errors

All numbers from the American Housing Survey (AHS), except for sample size, are estimates. As in other surveys, errors come primarily from the following:

- Incomplete data (Incomplete data are adjusted by assuming that the respondents are similar to those not answering, and the size of these errors is estimated.)
- Wrong answers (The U.S. Census Bureau does not adjust for wrong answers and does not estimate the size of the errors.)
- Sampling (Sampling errors are not adjusted and the size of the error is estimated.)

Incomplete data and wrong answers are usually the largest source of errors, larger than sampling errors. For example, in the American Housing Survey National (AHS-N), the changes in weighting in 1981 and 1991 (see Appendix C) corrected some of the error due to incomplete data. That one correction averaged 2.5 percent in 1991. Worse errors from incomplete data and from wrong answers apply to some items, discussed below.

Additional information on the quality of AHS data can be obtained from the U.S. Census Bureau, *American Housing Survey: A Quality Profile,* Series H121/95-1.

INCOMPLETE DATA

Coverage errors. Because of deficiencies with our sampling lists, the homes in the survey do not represent all homes in the country. The Census Bureau attempts to adjust for the deficiencies by raising the raw numbers from the survey proportionally, so that the numbers published here match independent estimates of the total number of homes. The approximate housing unit undercoverage rates for the 1998 metropolitan areas range from less than 1 percent to 4.4 percent. The approximate housing unit undercoverage rates for the 1999 AHS-National metropolitan areas range from less than 1 percent to 3.1 percent. Housing unit undercoverage is about 1.9 percent for the 1999 AHS-N.

The independent estimates changed around 2.5 percent in both 1981 and 1991 (after the 1980 and 1990 censuses, respectively), which implies that some error existed in the years just before the adjustment. The next correction will be after Census 2000. Before adjustments, undercoverage varies from 2 percent to 20 percent for major categories of units (see Table 2 in Appendix D of *American Housing Survey for the U.S. in 1995)* but is usually less than 2 percent, on average. Table U lists units that have known coverage deficiencies.

Table U. **Poorly Covered Units**

Type of unit	Type of deficiency
Mobile homes, boats, and recreational vehicles (RVs)	No coverage of new mobile home parks, new marinas, and new RV parks since April 1980 for AHS-N or April 1990 for AHS-MS, in areas where addresses are complete and permits are required for new construction.
Conventional new construction	No coverage of permits issued fewer than 8 months before interviewing or homes built without permits where permits are required. In addition, eligible units could be missed and ineligible units included because of incorrect answers to questions used to screen out ineligible units.
New construction in special places (for example, college campuses, prisons, etc.)	Not covered in either permit-issuing or nonpermit-issuing areas.
Group quarters and houses moved in	Eligible units could be missed because of incorrect answers to questions used to screen out ineligible units.
Conversions from nonresidential units	AHS-N: Minimal coverage of nonresidential units in buildings with no living quarters at the time of the 1980 census that converted to housing units by 1991 (and no coverage since 1991) in areas where addresses are complete and permits are required for new construction. AHS-MS: Nonresidential units at the time of the 1990 census that converted to residential units were missed.
Within-structure additions	Some extra apartments created illegally or occupied by fugitives are probably missed because people do not report them for fear of penalties.
Whole structure additions not covered by permit sampling	These units are chosen with the aid of screening questions. Eligible units could be missed and ineligible units included because of incorrect answers to the screening questions.

Missing data. Some people refuse the interview or some of the questions, or do not know the answers. When the entire interview is missing, other similar interviews represent the missing ones (see Appendix B). For most missing

answers, an answer from a similar household is copied.[1] The Census Bureau does not know how close the imputed values are to the actual values. For other items, "not reported" is used as an answer category. The items with the most missing data are primarily those that people forget or consider personal: mortgages, other housing costs, and income.

Incompleteness can cause large errors since, when even 10 percent of homes are missed by a particular question, they represent about 10 million homes that have to be estimated *on little or no basis* (there are about 100 million homes in the U.S.). The survey estimates them by assuming that they are like some group of homes that did give data, an assumption that is *never exactly true* although it is usually better than ignoring the homes with the missing data. Thus, it is not surprising that large biases, as shown in Tables V1, V2, and V3 in the tables section, are possible when the survey has data for only 50 to 90 percent of homes for particular items. Again, readers should be wary of items with highly incomplete data.[2]

Rates of completeness were not computed for 1999. Table 2 in Appendix D of *American Housing Survey for the U. S. in 1995* gives the completeness rates for 1995. Due to the change in data collection methodology, the rates for 1999 may be higher or lower than in the past. However, the items that were most incomplete in 1995 are probably still the most incomplete for 1999.

Effect on income. The nonsampling errors interact particularly badly for income. Income questions are inconsistently answered (Table W), incompletely answered, and the totals fall short of totals known from the National Income Accounts, especially for the elderly.[3]

Change over time. Several aspects of the AHS make estimates of change from previous data unreliable. These changes may elicit different answers from the past, even if nothing changed in the housing unit. Wording and question order for most questions changed. Also, the questionnaire now runs on interviewers' portable computers (as described in Appendix C), resulting in the following possible changes:

- The correct questions should be asked. Skip patterns will be followed more accurately.
- Inconsistent answers (such as reporting a move-in date before the date built) are probed during the interview, rather than just being changed in later computer processing, so these problems should be resolved more accurately.
- In AHS-N, for some questions, large changes from prior year data are probed during the interview, to reduce mistaken measurements of large change.
- Some respondents may dislike the presence of the computer, though interviewers do not report many problems.
- It is now a little harder for interviewers to go back to a question much earlier in the questionnaire if a respondent suddenly remembers something.

In the future, the Census Bureau may try to estimate the net effects of these differences.

WRONG ANSWERS

Wrong answers happen because people misunderstand questions, cannot recall the correct answer, or do not want to give the right answer. Table W shows which items have been measured for inconsistency when people are reinterviewed after a few weeks. The actual survey did not catch and reconcile these inconsistencies and continuously occurring errors are not measured at all. Thus, a high rate of wrong answers remains for some items. The Census Bureau categorizes these levels of inconsistency into three ranges:

1. Less than 20 is considered a low level of inconsistency.
2. Between 20 and 50 is considered a moderate level of inconsistency.
3. Greater than 50 is considered a high level of inconsistency indicating that responses are not reliable.

Not all questions have been checked for inconsistencies; the ones checked were the questions where inconsistencies seemed likely. Questions measuring opinions were likely to have high inconsistencies. For the 1998 AHS-MS and the 1999 AHS-N, the wording for some questions changed. This change is expected to lower the level of inconsistency for the changed items. The numbers in Table W are percents. They are nearly the same as 100 minus the correlation between answers in the original interview and the reinterview. For example, an inconsistency of 15 means a correlation of 85 percent, which is good. This is the correlation between answers to the same question, usually from the same respondents, a month apart. Wrong answers create wrong results and mean that data about groups (for example, income groups) are

[1] Hot deck allocation is used: an answer is copied from the most recently processed similar household before the household with the missing item.

[2] Statistical note: The November 1990 paper, *How Response Error, Missing Data and Undercoverage Bias Survey Data,* estimates that 90 percent of errors from incomplete data are less than: 1.645 x (.0012 x U + .0363 x (lesser of A or U A)) where A is any count from the AHS and U is the total number of housing units in the U.S. or metropolitan area (both in thousands, result also in thousands). Weights are adjusted to reduce these errors, but it is not known how much error remains. *How Response Error, Missing Data and Undercoverage Bias Survey Data,* order number HUD-6458, is available from HUD USER (see "Where to Get AHS Data").

[3] Data are in the *Codebook for the American Housing Survey Volume 1,* available from HUD USER. Newer comparisons, though for a different survey, are in *Money Income of Households Families, and Persons in the United States: 1992,* Series P60-184, pages C12-C14, available from the Superintendent of Documents (see "Where to get AHS data").

infected with data from people who really are not like the group at all. Errors are especially troublesome for rare items for which even small errors overwhelm the true data. Readers should be wary of drawing firm conclusions from items with high levels of inconsistency or from categories smaller than a few million homes.

Possible effects of telephone interviewing on the data. A new sample was selected for the 1998 AHS-MS. All interviews were initial interviews (never interviewed before). A subset of the 1998 sample was interviewed by telephone. This was the first time that the AHS allowed initial interviews to be conducted by telephone. It is not known what, if any, effect telephone interviewing had on the 1998 results.

SAMPLING ERRORS

Definition. Errors from sampling reflect how estimates from a sample vary from the actual value. (Note: "actual value" means the value derived if all housing units had been interviewed under the same conditions, rather than only a sample.) A confidence interval is a range that contains the actual value with a specified probability. The range of nonsampling error is usually larger than this confidence interval.

Counts. Most numbers from the AHS are counts of housing units (for example, units with basements or units with elderly persons). These counts have error from sampling. As with the other types of errors, readers should be wary of numbers with large errors from sampling.

Table X1 gives a convenient list of errors for a range of numbers for 1999 AHS-N. The error from sampling cannot be known exactly. For numbers not in Table X1, the error from sampling is approximated using the following formula for constructing a 90-percent confidence interval:

$$1.645 \times \sqrt{4.74 \times A - .000041 \times A^2}$$

where A is a number (a count of units in thousands) from the AHS. This formula is an overestimate for most items. For more accurate estimates, use the formula in Table Y.

For example if A is 200:

$$1.645 \times \sqrt{4.74 \times 200 - .000041 \times 200 \times 200} = 50$$

The 90-percent confidence interval can then be formed by adding and subtracting this error to the survey estimate of 200 (that is, 200 plus or minus 50). Statements such as "the actual value is in the range 200 plus or minus 50 (150 to 250)," are right 90 percent of the time and wrong 10 percent of the time.[4]

Numbers in the book are printed in thousands, so 200 means 200,000. The formulas are designed to use numbers directly from the book; do not add zeros. The result is also in thousands, so 50 means 50,000.

Tables X2 and X3 give a list of errors for a range of numbers for the 1999 AHS-National metropolitan areas and the 1998 AHS-MS, respectively. For numbers not found in this table, interpolate between the numbers in the table or use the appropriate formula from Table Z for the 1998 AHS-MS and the 1999 AHS-National metropolitan areas. Remember, in any case, that the total error is larger than the sampling error.

Percents. Any subgroup can be shown as a percent of a larger group. For AHS-N, the error from sampling for a 90-percent confidence interval for this percent is:

$$1.645 \times \sqrt{4.74\ p\ (100 - p)\ /A}$$

where p is the percent; A is the denominator, or base of the percent in thousands.

For example, the error from sampling for a 90-percent confidence interval for 40 percent of 200 (meaning 200,000) is:

$$1.645 \times \sqrt{4.74 \times 40 \times 60/200} = 12.4$$

Statements such as "the actual percent is in the range 27.6 percent to 52.4 percent" are right 90 percent of the time.

This formula is an overestimate for most items. To get a more accurate estimate for AHS-N, replace the first number under the square root sign above with the first number under the square root sign of the formula for the appropriate universe in Table Y.[5]

For AHS-MS and AHS-National metropolitan areas, use the appropriate formula in Table AA.

Note that when a ratio C/D is computed when C is not a subgroup of D (for example, the number of Hispanics as a ratio of the number of Blacks) the error from sampling is different.[6]

Medians. The steps in Table BB calculate the error from sampling for a 90-percent confidence interval for a median. This is an approximation to the error.

For small bases the confidence interval on medians can not be estimated reliably. To estimate a median's sampling error more accurately, find the sampling error on 50 percent as described in Table CC and compute the 90-percent confidence interval.

[4]The formula in the text is based on 1.645 times the standard error from sampling. This formula gives "90-percent confidence interval errors." For 95-percent confidence interval errors, multiply by 1.960 instead of 1.645; for 99-percent confidence, multiply by 2.576 instead of 1.645.

[5]This formula is actually $1.645 \times \sqrt{(p(100-p)/n)}$, since 4.74/A adjusts the data to the effective sample size.

[6]The error from sampling for a 90-percent confidence interval for a ratio C/D is

$$C/D \sqrt{(\text{error for C/C})^2 + (\text{error for D/D})^2}$$

when the error for C should be interpreted as the error for a 90-percent confidence interval for C. Likewise, the error for D should be interpreted as the error for a 90-percent confidence interval for D.

Differences. Two numbers from the AHS, like 34 and 40, or 40 percent and 45 percent have a "statistically significant difference" if their ranges of error from sampling for a 90-percent confidence interval do not overlap.[7]

Formulas for Error From Sampling. The letter "A" in the formulas in Tables Y, Z, and AA represents a number (a count of units in thousands) from AHS, (see the "Counts" section for an example of how "A" is used). For AHS-N, the minimum error from sampling is ±10 (meaning ±10 thousand).[8] If a formula gives an error smaller than 10, use 10.

For a 90-percent confidence interval on zero for the 1998 AHS-MS, refer to Table X3, where the size of the estimate is zero. For a 90-percent confidence interval on zero for the 1999 AHS-N metropolitan areas, refer to Table X2. If a formula gives an error smaller than the error for zero, use the error for zero.

The formulas give the errors for a 90-percent confidence interval. For a 95-percent confidence interval, multiply by 1.960 instead of 1.645; for a 99-percent confidence interval, multiply by 2.576 instead of 1.645.

For AHS-N, if an item falls into two different categories in Table Y, use the formula that gives the largest error. For example, for Hispanics' income in the South, use the formulas for the South (since there is no specific formula for income and errors for the South will be bigger than those for Hispanics). For the following neighborhood characteristics, use the neighborhood formulas:

- Opinion of neighborhood
- Street noise or traffic
- Neighborhood crime
- Odors
- Other bothersome neighborhood conditions
- Public elementary school
- Public transportation
- Neighborhood shopping
- Police protection
- Parking lots
- Description of area (except open space, park, farm, or ranch) within 300 feet
- Age of other residential buildings within 300 feet
- Other buildings vandalized or with interior exposed within 300 feet
- Bars on windows of buildings within 300 feet
- Conditions of streets within 300 feet
- Trash, litter, or junk on streets or any properties within 300 feet
- Mobile homes in group

For the following items, which have larger standard errors, use the special characteristics formulas:

- Cooperatives or condominiums
- No complete bathroom
- Less than 1,500 square feet of detached one-family or mobile homes
- Well serving 1 to 5 units
- Mobile homes in a group
- Area within 300 feet includes open space, park, farm, or ranch
- Septic tank, cesspool, chemical toilet
- Five or more acres in lot size
- No bedroom
- Lacking complete kitchen facilities
- Lacking some plumbing facilities
- No flush toilet
- Major street repairs needed

Table V1. **Errors for Incomplete Data Bias: 1999 AHS-N**

[Numbers in thousands]

When the AHS gives one of the following numbers	The chances are 90 percent that the complete value[1] is inside the range of plus or minus
0	226
10	227
100	232
1,000	286
2,500	375
5,000	524
10,000	822
25,000	1,715
50,000	3,203
75,000	2,608
100,000	1,119
115,000	226

[1] "Complete value" means the value derived if there were no missing data.

[7] When ranges of error from sampling for a 90-percent confidence interval do overlap, numbers are still statistically different if the result of subtracting one from the other is more than $\sqrt{(\text{error for first number})^2 + (\text{error for second number})^2}$ The error for the first and second numbers should be interpreted as the error for a 90-percent confidence interval for the first and second numbers respectively.

[8] This minimum formula is based on the binomial 90-percent confidence interval on zero U x (1 .1$^{4.74/U}$) =10 (where U is the total number of homes from the AHS). For a 95-percent confidence interval, substitute .05 for .1 in the above formula. For a 99-percent confidence interval, substitute .01 for .1. More discussion and other approximations are in the paper "Sampling Errors for Small Groups" available from HUD USER (see "Where to Get AHS Data").

Table V2. **Errors for Incomplete Data Bias: 1999 AHS-N Metropolitan Areas**

[Numbers in thousands]

Size of estimate	Chicago, IL	Detroit, MI	Los Angeles-Long Beach, CA	New York-Nassau-Suffolk-Newburgh, NY	Northern New Jersey	Philadelphia, PA-NJ
0	6.0	3.7	6.5	9.1	4.9	4.0
10	6.6	4.3	7.0	9.7	5.5	4.6
25	7.5	5.2	7.9	10.6	6.4	5.5
50	9.0	6.7	9.4	12.1	7.9	7.0
100	12.0	9.6	12.4	15.0	10.9	9.9
300	23.9	21.6	24.3	26.9	22.8	21.8
500	35.8	33.5	36.2	38.9	34.7	33.8
700	47.7	45.4	48.1	50.8	46.6	45.7
1,100	71.5	49.9	71.9	74.6	70.4	59.1
1,200	77.5	44.0	77.9	80.5	76.4	53.1
1,400	89.4	32.1	89.8	92.4	70.5	41.2
2,000	69.2	NA	82.6	128.1	34.8	5.5
2,500	39.4	NA	52.8	135.0	5.0	NA
3,000	9.6	NA	23.0	105.3	NA	NA
3,500	NA	NA	NA	75.5	NA	NA
4,000	NA	NA	NA	45.8	NA	NA
4,500	NA	NA	NA	16.0	NA	NA

NA means no error estimates are provided because the estimate is larger than the estimated total number of housing units in the MSA.

Table V3. **Errors for Incomplete Data Bias: 1998 AHS-MS**

[Numbers in thousands]

Size of estimate	Baltimore, MD	Birmingham, AL	Boston, MA-NH	Cincinnati, OH-KY-IN	Houston, TX	Minneapolis-St. Paul, MN-WI	Norfolk-Virginia Beach-Newport News, VA-NC	Oakland, CA	Providence-Pawtucket-Warwick, RI-MA	Rochester, NY	Salt Lake City, UT	San Francisco, CA	San Jose, CA	Tampa-St. Petersburg, FL	Washington DC-MD-VA
0	2.0	0.8	2.6	1.3	3.0	2.3	1.2	1.8	0.8	0.9	0.9	1.4	1.2	2.2	3.6
10	2.6	1.4	3.2	1.9	3.6	2.9	1.8	2.4	1.4	1.5	1.5	2.0	1.8	2.8	4.2
100	8.0	6.7	8.6	7.2	9.0	8.2	7.2	7.7	6.8	6.8	6.8	7.3	7.1	8.2	9.5
250	16.9	9.3	17.5	16.2	17.9	17.1	16.1	16.6	10.7	12.7	12.4	16.3	16.0	17.1	18.5
500	31.8	NA	32.4	10.1	32.8	32.0	9.1	25.3	NA	NA	NA	13.3	6.6	32.0	33.3
750	18.6	NA	38.1	NA	47.7	26.1	NA	10.4	NA	NA	NA	NA	NA	25.4	48.2
1,000	3.7	NA	23.2	NA	35.6	11.2	NA	NA	NA	NA	NA	NA	NA	10.5	52.2
1,250	NA	NA	8.4	NA	20.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	37.4
1,500	NA	NA	NA	NA	5.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	22.5
1,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	16.5

NA means no error estimates are provided because the estimate is larger than the estimated total number of housing units in the MSA.

Table W. **Different Answers a Month Apart**

Item	Level of inconsistency[1]	Confidence interval [2]	When measured [3]
HIGH LEVEL OF INCONSISTENCY			
Other kinds of heating equipment (central warm-air)	91	(73 - 100)	89-MS
Mortgage payment includes anything else (first mortgage)	90	(72 - 111)	90-MS
Water came in from other places	81	(64 - 100)	89-MS
Moved for other, financial/employment	80	(62 - 104)	85-MS
Moved for other, housing related	79	(65 - 97)	85-MS
Poor city/county service in neighborhood	78	(63 - 95)	89-MS
Police protection problem in neighborhood	78	(63 - 95)	89-MS
Number of business rooms with direct access to outside	76	(63 - 91)	95-N
Moved for other reasons	73	(64 - 85)	85-MS
Number of other rooms	73	(64 - 83)	95-N
Difficulty hearing with or without a hearing aid	72	(59 - 88)	95-N
Rooms used both as business space and for something else	70	(62 - 80)	95-N
Cost for routine repairs and maintenance	70	(65 - 75)	95-N
Moved for better quality house	69	(58 - 82)	85-MS
Moved for other family/personal related	68	(54 - 86)	85-MS
Cost for water supply and sewage disposal	68	(61 - 76)	81-N
Lower cost State or local mortgage	67	(54 - 83)	95-N
Other problem in neighborhood	67	(61 - 74)	89-MS
Number of living rooms	66	(53 - 82)	95-N
Shed, detached garage, or other building added or replaced in last 2 years	66	(49 - 88)	95-N
Water safe for drinking	66	(56 - 77)	95-N
Undesirable industries/businesses in neighborhood	66	(54 - 82)	89-MS
Difficulty reaching kitchen facilities	65	(49 - 87)	95-N
Number of family rooms, dens, recreation rooms and/or libraries	65	(57 - 75)	95-N
Rats	65	(54 - 69)	89-MS
Difficulty opening, closing, or going through any doors of home	64	(46 - 87)	95-N
Noise in neighborhood	64	(57 - 72)	89-MS
Difficulty moving between rooms	64	(49 - 84)	95-N
Number of business rooms without direct access to outside	64	(54 - 76)	95-N
Peeling paint on the ceiling	63	(49 - 80)	81-N
Other kinds of heating equipment (none)	63	(60 - 67)	89-MS
How LIKELY to move to place prefer to live in 5 years	62	(54 - 71)	85-MS
Difficulty reaching bathroom facilities	62	(47 - 82)	95-N
Other kinds of heating equipment (unvented room)	62	(45 - 86)	89-MS
Difficulty seeing with or without glasses or contact lenses	60	(49 - 72)	95-N
How LIKELY to still be living in this unit in 5 years	60	(49 - 74)	85-MS
Gross income	59	Not available	82-MS
Number of days worked at home	59	(49 - 72)	95-N
Patio, terrace, or detached deck added or replaced in last 2 years	58	(42 - 81)	95-N
Electric fuses or breaker switches blown	58	(50 - 68)	81-N
Open cracks or holes in building	58	(47 - 72)	81-N
People in neighborhood	57	(52 - 62)	89-MS
Other major repairs over $500 each—repair done	57	(50 - 64)	85-MS
Work done in last 2 years to attic, basement, garage, or unfinished area of home	56	(44 - 71)	95-N
Difficulty going up and down steps	56	(46 - 69)	95-N
Central air conditioning/dehumidifier	56	Not available	80-N
Satisfactory police protection	55	(49 - 62)	77-N
Moved for lower rent or less expensive house to maintain	55	(43 - 70)	85-MS
Broken plaster or peeling paint	55	(46 - 65)	89-MS
Water came in from walls, doors, windows	55	(45 - 67)	89-MS
A working electric wall outlet	55	(42 - 71)	77-N
Home equity loans	55	(48 - 64)	95-N
Other kinds of heating equipment (fireplace with no insert)	54	(49 - 59)	89-MS
Shopping	54	(47 - 61)	77-N
Special modifications, equipment, or assistance needed because of physical limitation	54	(44 - 66)	95-N

Table W. **Different Answers a Month Apart**—Con.

Item	Level of inconsistency[1]	Confidence interval [2]	When measured [3]
HIGH LEVEL OF INCONSISTENCY—Con.			
Difficulty entering and exiting home	54	(43 - 67)	95-N
Broken plaster on the ceiling	53	(40 - 70)	81-N
Water came in from roof	53	(46 - 60)	89-MS
Driveways or walkways added or replaced in last 2 years	53	(42 - 67)	95-N
Difficulty with personal activities—bathing/showering	53	(42 - 66)	95-N
Payments the same during whole length of the mortgage	52	(46 - 59)	85-MS
Difficulty with personal activities—cooking and preparing food	52	(41 - 66)	95-N
Other major repairs over $500 each—someone in household do work	51	(36 - 72)	85-MS
Number of hours worked at home as self-employed, contract worker, or business owner	51	(43 - 61)	95-N
Litter in neighborhood	51	(44 - 60)	89-MS
Which best describes place at that time	51	(46 - 55)	85-MS
Rate the place (10 categories)	51	(49 - 53)	89-MS
Main reason moved	51	(47 - 55)	85-MS
Yearly cost for garbage	51	(43 - 62)	81-N
MODERATE LEVEL OF INCONSISTENCY			
Holes in the floors	50	(33 - 74)	81-N
Type of vacant	50	(38 - 65)	81-N
Cookstove or range with oven	50	(39 - 64)	85-N
Public transportation	50	(44 - 56)	77-N
Oil, coal, kerosene, wood and any other fuel cost	50	(40 - 64)	81-N
Other kinds of heating equipment (other built-in electric)	50	(38 - 66)	89-MS
Central air fuel	50	(40 - 63)	85-N
At age 16, live in this area/different place	50	(44 - 57)	85-MS
Difficulty with personal activities—housework/laundry	50	(41 - 61)	95-N
Do work at home	50	(43 - 58)	95-N
Traffic in neighborhood	49	(43 - 54)	89-MS
Moved to establish own household	48	(38 - 59)	85-MS
Rate the place (categories 1-6 combined)	48	(46 - 51)	89-MS
Fencing or walls added or replaced in last 2 years	48	(37 - 61)	95-N
Drive to work alone or with others	48	(38 - 59)	95-N
Real estate taxes	47	(33 - 67)	81-N
Other kinds of heating equipment (portable electric)	47	(41 - 54)	89-MS
Central air conditioning/none	47	Not available	80-N
Crime in neighborhood	47	(41 - 53)	89-MS
Bathroom or kitchen remodeled in last 2 years	46	(39 - 54)	95-N
Fixed place of work	46	(37 - 57)	95-N
Any additions built—repair done	46	(35 - 61)	85-MS
Water came in from basement	45	(38 - 55)	89-MS
Any other rooms	45	(42 - 49)	95-N
Moved to change from owner to renter/renter to owner	44	(36 - 55)	85-MS
Five years from now, would you prefer living in this area or someplace else	44	(32 - 60)	80-N
Major equipment, such as furnace or central air replaced or added—repair done	44	(35 - 55)	85-MS
Major disaster in last 2 years required repairs	44	(31 - 60)	95-N
Water leaked into home from outdoors	43	(39 - 47)	89-MS
Concealed wiring	43	(33 - 57)	89-MS
Other kinds of heating equipment (fireplace with insert)	43	(35 - 52)	89-MS
Rate the place (4 combined categories)	43	(41 - 46)	89-MS
Difficulty with personal activities—grooming/dressing	43	(30 - 60)	95-N
Siding replaced or added in last 2 years—repair done	42	(32 - 56)	85-MS
Moved to be closer to school/work	41	(32 - 53)	85-MS
Yearly cost of insurance (reported in $100 increments to $1,000)	41	(38 - 44)	89-MS
Heat breakdown	41	(30 - 56)	89-MS
Heating equipment broke down for 6 hours or more	41	(30 - 56)	89-MS
Public elementary school satisfactory	40	(34 - 47)	89-MS
Cost for real estate taxes	40	(35 - 46)	81-N

Table W. **Different Answers a Month Apart**—Con.

Item	Level of inconsistency[1]	Confidence interval [2]	When measured [3]
MODERATE LEVEL OF INCONSISTENCY—Con.			
Mice or rats or signs of	40	Not available	76-N
House/apartment cold for 24 hours	40	(36 - 45)	89-MS
Central air conditioning/portable fan	40	Not available	80-N
Current mortgage same year as bought home	39	(27 - 56)	85-MS
Mode of transportation to work last week	38	(31 - 46)	95-N
Anything about the neighborhood that bothers you	38	(35 - 41)	89-MS
Prefer to be living in another home in this area in 5 years	38	(31 - 48)	85-MS
Change in taxes/insurance/principal balance	37	(28 - 51)	85-MS
Number of mortgages on home/property	36	(28 - 47)	95-N
Other kinds of heating equipment (stove)	36	(28 - 47)	89-MS
Costs for gas for the month of August	35	(24 - 54)	89-N
Bathrooms remodeled or added—repair done	35	(28 - 45)	85-MS
All or part of roof replaced in last 2 years—repair done	35	(29 - 42)	85-MS
Married, widowed, divorced, or separated	35	Not available	85-MS
Number of dining rooms	35	(32 - 38)	95-N
Highest level of school/degree	34	(32 - 35)	95-N
New storm doors or storm windows bought and installed—repair done	33	(27 - 41)	85-MS
Moved because needed larger house or apartment	33	(26 - 41)	85-MS
Number of homes source of water serving	33	(22 - 49)	95-N
Insulation added—repair done	32	(25 - 44)	85-MS
Kitchen remodeled or added - repair done	32	(25 - 41)	85-MS
House and lot sell on today's market	31	(29 - 34)	90-MS
Moved for new job or job transfer	30	(22 - 39)	85-MS
Average monthly cost for gas	29	(23 - 37)	89-N
Average monthly cost for electricity	28	(24 - 34)	89-N
Type of mortgage (for the first mortgage/loan) (nonCATI)[4]	27	(21 - 36)	89-N
Change based on interest rates	26	(18 - 38)	85-MS
Year the building was built	25	Not available	85-MS
All or part of roof replaced in last 2 years—someone in household do work	25	(15 - 44)	85-MS
Number of family rooms	25	(21 - 30)	85-N
Mortgage payment include homeowner's insurance (first mortgage)	24	(21 - 27)	90-MS
Prefer to be living in this house/apartment/someplace else	24	(20 - 29)	85-MS
Number of half bathrooms	24	(20 - 27)	95-N
Clothes washer age	22	(19 - 25)	85-N
How many years for mortgage	22	(17 - 29)	85-MS
LOW LEVEL OF INCONSISTENCY			
Attend a public school or a private school	19	(15 - 25)	89-MS
New storm doors or storm windows bought and installed—someone in household do work	19	(11 - 35)	85-MS
Garbage disposal age	18	(15 - 22)	85-N
Refrigerator age	18	(16 - 20)	85-N
Heating equipment broke	18	(9 - 34)	89-MS
Clothes dryer age	18	(15 - 21)	85-N
Oven/cooking burner age	18	(16 - 21)	85-N
Monthly payment (first mortgage)	16	(14 - 18)	90-MS
Insulation added—someone in household do work	16	(8 - 33)	85-MS
New storm doors or storm windows bought and installed—job cost	15	(8 - 32)	85-MS
Mortgage payment include property tax (first mortgage)	15	(12 - 18)	90-MS
New/assumed mortgage	15	(11 - 22)	85-MS
How much was borrowed	14	(11 - 18)	85-MS
Monthly payment (for first mortgage/loan) (non-CATI)[4]	14	(11 - 19)	89-N
Mortgage, home equity loan or other loan on this house/ apartment	14	(11 - 17)	95-N
Dishwasher age	14	(11 - 17)	85-N
Number of full bathrooms	13	(11 - 15)	95-N
Where was mortgage borrowed (non-CATI)[4]	13	(7 - 28)	89-N
How much was borrowed (for the first mortgage/loan) (non-CATI)[4]	13	(10 - 17)	89-N
Number of bedrooms	12	(11 - 14)	95-N

Table W. **Different Answers a Month Apart**—Con.

Item	Level of inconsistency[1]	Confidence interval [2]	When measured [3]
LOW LEVEL OF INCONSISTENCY—Con.			
Clothes dryer fuel	12	(9 - 14)	85-N
Have property insurance	12	(10 - 14)	89-MS
Number of room air conditioners	11	(9 - 15)	85-N
Room air conditioners	10	(8 - 12)	85-N
Interest rate on the mortgage (for the first mortgage/loan) (non-CATI)[4]	10	(7 - 15)	89-N
Source of water serving 15 or more homes	10	(8 - 13)	95-N
Kitchen remodeled or added—someone in household do work	9	(3 - 26)	85-MS
Number of units in building	8	(6 - 9)	85-N
Clothes washer	8	(6 - 9)	85-N
Living quarters	8	(6 - 9)	85-N
Source of water	8	(6 -11)	95-N
Dishwasher	6	(5 - 7)	85-N
Garbage disposal	5	(4 - 7)	85-N
Number of apartments	5	(4 - 8)	85-N
Central air conditioning	5	(4 - 6)	85-N
Clothes dryer	5	(4 - 7)	85-N
Cooking fuel	5	(4 - 6)	85-N

[1]Levels are in percents. They are nearly the same as 100 minus the correlation between answers in the original interview and the reinterview a month later. For example, an inconsistency of 80 means a correlation of 20 percent, which is not good.
[2]Square brackets show 90-percent confidence intervals. Parentheses show 95-percent confidence intervals (used in 1988 and before).
[3]Measured in national surveys (N) or metropolitan surveys (MS).
[4]CATI is computer-assisted telephone interviewing; where shown, inconsistency was measured separately for CATI and non-CATI interviews.

Table X1. **Errors From Sampling: 1999 AHS-N**

[Numbers in thousands]

When the AHS gives one of the following numbers	The chances are 90 percent that the actual value is inside the range of plus or minus
0	10
10	11
100	36
1,000	112
2,500	177
5,000	247
10,000	341
25,000	500
50,000	601
75,000	580
100,000	415
115,000	88

Source: These errors were computed based on a formula in Table Y with high error. This table represents a conservative example.

Table X2. **Errors From Sampling to Compute a 90-Percent Confidence Interval: 1999 AHS-N Metropolitan Areas**

(Numbers in thousands)

Size of estimate	Chicago, IL	Detroit, MI	Los Angeles-Long Beach, CA	New York-Nassau-Suffolk-Newburgh, NY	Northern New Jersey	Philadelphia, PA-NJ
0	1.1	1.1	1.1	2.4	2.3	1.1
10	5.4	5.4	5.4	7.9	7.8	5.4
25	8.6	8.5	8.6	12.5	12.4	8.5
50	12.1	12.0	12.1	17.7	17.4	12.0
100	16.9	16.7	16.9	24.9	24.4	16.8
300	28.3	27.3	28.4	42.1	40.4	27.5
500	35.2	32.9	35.4	53.1	49.8	33.4
700	40.0	36.0	40.4	61.3	55.8	36.8
1,100	45.7	36.7	46.5	72.8	61.8	38.6
1,200	46.5	35.8	47.4	74.9	62.2	38.0
1,400	47.4	32.4	48.7	78.5	61.8	35.8
2,000	45.3	NA	48.0	84.6	49.9	8.7
2,500	36.9	NA	41.8	85.1	4.1	NA
3,000	13.6	NA	27.2	81.5	NA	NA
3,500	NA	NA	NA	73.2	NA	NA
4,000	NA	NA	NA	58.1	NA	NA
4,500	NA	NA	NA	26.8	NA	NA

NA means no error estimates are provided because the estimate is larger than the estimated total number of housing units in the MSA.

Table X3. **Errors From Sampling to Compute a 90-Percent Confidence Interval: 1998 AHS-MS**

[Numbers in thousands]

Size of estimate	Baltimore, MD	Birmingham, AL	Boston, MA-NH	Cincinnati, OH-KY-IN	Houston, TX	Minneapolis-St. Paul, MN-WI	Norfolk-Virginia Beach-Newport News, VA-NC	Oakland, CA	Providence-Pawtucket-Warwick, RI-MA	Rochester, NY	Salt Lake City, UT	San Francisco, CA	San Jose, CA	Tampa-St. Petersburg, FL	Washington DC-MD-VA
0	0.6	0.2	0.9	0.4	0.9	0.7	0.4	0.5	0.3	0.3	0.3	0.4	0.3	0.7	1.1
1	0.9	0.5	1.0	0.7	1.0	0.9	0.7	0.8	0.5	0.6	0.6	0.7	0.6	0.9	1.1
5	1.9	1.2	2.2	1.6	2.3	2.0	1.5	1.8	1.2	1.3	1.2	1.6	1.4	2.0	2.5
10	2.7	1.7	3.1	2.2	3.2	2.8	2.1	2.5	1.7	1.8	1.7	2.2	2.0	2.8	3.5
25	4.2	2.6	4.9	3.5	5.1	4.4	3.2	3.9	2.6	2.8	2.7	3.5	3.1	4.4	5.6
50	5.9	3.5	6.9	4.8	7.1	6.2	4.5	5.4	3.6	3.8	3.7	4.8	4.3	6.1	7.8
100	8.1	4.6	9.6	6.5	9.9	8.6	6.0	7.4	4.7	5.0	4.9	6.5	5.8	8.4	10.9
300	12.4	4.5	15.2	8.9	15.9	13.4	8.2	11.1	5.0	5.7	5.5	9.2	7.7	13.1	17.7
500	13.6	NA	17.7	7.5	18.8	15.1	6.7	11.7	NA	NA	NA	8.4	5.6	14.8	21.3
700	12.7	NA	18.3	NA	20.1	14.9	NA	9.7	NA	NA	NA	0.6	NA	14.5	23.2
1,000	4.3	NA	16.0	NA	19.3	10.2	NA	NA		NA	NA	NA	NA	9.7	23.7
1,200	NA	NA	11.4	NA	16.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	22.6
1,400	NA	NA	NA	NA	11.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	20.0
1,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15.4
1,800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.5

NA means no error estimates are provided because the estimate is larger than the estimated total number of housing units in the MSA.

Table Y. **Formulas for 90-Percent Confidence Intervals: 1999 AHS-N**

Characteristics	General formulas— All characteristics except those listed under other formulas	Other formulas	
		Fuels, heating/cooling equipment and neighborhood characteristics	Special characteristics
Total units, elderly, new construction, vacants, Northeast, Midwest, West	$1.645 \times \sqrt{2.48 \times A - 0.000022 \times A^2}$	$1.645 \times \sqrt{4.74 \times A - 0.000041 \times A^2}$	$1.645 \times \sqrt{5.53 \times A + 0.000605 \times A^2}$
Central city, mobile homes, Hispanic, urban, suburbs, Black	$1.645 \times \sqrt{2.48 \times A - 0.000022 \times A^2}$	$1.645 \times \sqrt{2.48 \times A - 0.000022 \times A^2}$	$1.645 \times \sqrt{3.52 \times A + 0.000924 \times A^2}$
Rural, South, outside (P)MSAs	$1.645 \times \sqrt{3.12 \times A - 0.000027 \times A^2}$	$1.645 \times \sqrt{4.74 \times A - 0.000041 \times A^2}$	$1.645 \times \sqrt{5.53 \times A + 0.000605 \times A^2}$

Table Z. **Formulas for 90-percent Confidence Intervals[1]: 1998 AHS-MS**

MSA	The formula is:
1998 AHS-MS	
Baltimore, MD	
Mobile home estimates	$1.645 \times \sqrt{(.405 \times A) - (.024994 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.270 \times A) - (.000263 \times A^2)}$
Birmingham, AL	
Mobile home estimates	$1.645 \times \sqrt{(.180 \times A) - (.005367 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.105 \times A) - (.000266 \times A^2)}$
Boston, MA-NH	
Mobile home estimates	$1.645 \times \sqrt{(.515 \times A) - (.037632 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.370 \times A) - (.000275 \times A^2)}$
Cincinnati, OH-KY-IN	
Mobile home estimates	$1.645 \times \sqrt{(.315 \times A) - (.014593 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.185 \times A) - (.000286 \times A^2)}$
Houston, TX	
Mobile home estimates	$1.645 \times \sqrt{(.620 \times A) - (.009146 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.390 \times A) - (.000252 \times A^2)}$
Minneapolis-St. Paul, MN-WI	
Mobile home estimates	$1.645 \times \sqrt{(.445 \times A) - (.015859 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.300 \times A) - (.000261 \times A^2)}$
Norfolk-Virginia Beach-Newport News, VA-NC	
Mobile home estimates	$1.645 \times \sqrt{(.255 \times A) - (.010117 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.160 \times A) - (.000253 \times A^2)}$
Oakland, CA	
Mobile home estimates	$1.645 \times \sqrt{(.320 \times A) - (.019269 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.230 \times A) - (.000257 \times A^2)}$
Providence-Pawtucket-Warwick, RI-MA	
Mobile home estimates	$1.645 \times \sqrt{(.165 \times A) - (.029162 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.110 \times A) - (.000265 \times A^2)}$
Rochester, NY	
Mobile home estimates	$1.645 \times \sqrt{(.175 \times A) - (.008538 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.120 \times A) - (.000268 \times A^2)}$
Salt Lake City, UT	
Mobile home estimates	$1.645 \times \sqrt{(.115 \times A) - (.007892 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.115 \times A) - (.000259 \times A^2)}$
San Francisco, CA	
Mobile home estimates	$1.645 \times \sqrt{(.235 \times A) - (.039167 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.185 \times A) - (.000264 \times A^2)}$

Table Z. **Formulas for 90-percent Confidence Intervals[1]: 1998 AHS-MS**—Con.

MSA	The formula is:
1998 AHS-MS—Con.	
San Jose, CA	
Mobile home estimates	$1.645 \times \sqrt{(.150 \times A) - (.006167 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.150 \times A) - (.000254 \times A^2)}$
Tampa-St. Petersburg, FL	
Mobile home estimates	$1.645 \times \sqrt{(.375 \times A) - (.001870 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.290 \times A) - (.000255 \times A^2)}$
Washington, DC-MD-VA	
Mobile home estimates	$1.645 \times \sqrt{(.740 \times A) - (.046204 \times A^2)}$
All other estimates[2]	$1.645 \times \sqrt{(.465 \times A) - (.000256 \times A^2)}$
1999 AHS-N Metropolitan Areas	
Chicago, IL	$1.645 \times \sqrt{(1.100 \times A) - (.000359 \times A^2)}$
Detroit, MI	$1.645 \times \sqrt{(1.100 \times A) - (.000586 \times A^2)}$
Los Angeles-Long Beach, CA	$1.645 \times \sqrt{(1.100 \times A) - (.000336 \times A^2)}$
New York-Nassau-Suffolk-Newburgh, NY	$1.645 \times \sqrt{(2.350 \times A) - (.000509 \times A^2)}$
Northern New Jersey	$1.645 \times \sqrt{(2.300 \times A) - (.000919 \times A^2)}$
Philadelphia, PA-NJ	$1.645 \times \sqrt{(1.100 \times A) - (.000543 \times A^2)}$

[1]The formulas in the text are based on 1.645 times the errors from sampling. This formula gives 90-percent confidence interval errors. For 95-percent confidence interval errors, multiply by 1.960 instead of 1.645; for 99-percent confidence, multiply by 2.576 instead of 1.645.

[2]Some items (for example, characteristic of total housing units) may involve housing units from both the mobile home and nonmobile home universe. The formulas for all other estimates should be used for these items. The formulas for mobile home estimates should be used for items that only involve housing units from the mobile home universe.

Table AA. **Formulas for 90-percent Confidence Intervals Associated With a Percentage**

MSA and estimates type	The formula is:[1]
1998 AHS-MS	
Baltimore, MD	
Mobile home estimates	$1.645 \times \sqrt{(.405 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.270 \times p \times (100 - p))/A}$
Birmingham, AL	
Mobile home estimates	$1.645 \times \sqrt{(.180 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.105 \times p \times (100 - p))/A}$
Boston, MA-NH	
Mobile home estimates	$1.645 \times \sqrt{(.515 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.370 \times p \times (100 - p))/A}$
Cincinnati, OH-KY-IN	
Mobile home estimates	$1.645 \times \sqrt{(.315 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.185 \times p \times (100 - p))/A}$
Houston, TX	
Mobile home estimates	$1.645 \times \sqrt{(.620 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.390 \times p \times (100 - p))/A}$
Minneapolis-St. Paul, MN-WI	
Mobile home estimates	$1.645 \times \sqrt{(.445 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.300 \times p \times (100 - p))/A}$
Norfolk-Virginia Beach-Newport News, VA-NC	
Mobile home estimates	$1.645 \times \sqrt{(.255 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.160 \times p \times (100 - p))/A}$
Oakland, CA	
Mobile home estimates	$1.645 \times \sqrt{(.320 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.230 \times p \times (100 - p))/A}$
Providence-Pawtucket-Warwick, RI-MA	
Mobile home estimates	$1.645 \times \sqrt{(.165 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.110 \times p \times (100 - p))/A}$
Rochester, NY	
Mobile home estimates	$1.645 \times \sqrt{(.175 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.120 \times p \times (100 - p))/A}$
Salt Lake City, UT	
Mobile home estimates	$1.645 \times \sqrt{(.115 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.115 \times p \times (100 - p))/A}$
San Francisco, CA	
Mobile home estimates	$1.645 \times \sqrt{(.235 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.185 \times p \times (100 - p))/A}$
San Jose, CA	
Mobile home estimates	$1.645 \times \sqrt{(.150 \times p \times (100 - p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.150 \times p \times (100 - p))/A}$

Table AA. **Formulas for 90-percent Confidence Intervals Associated With a Percentage**—Con.

MSA and estimates type	The formula is:[1]
1998 AHS-MS—Con.	
Tampa-St. Petersburg, FL	
Mobile home estimates	$1.645 \times \sqrt{(.375 \times p \times (100\ \ p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.290 \times p \times (100\ \ p))/A}$
Washington, DC-MD-VA	
Mobile home estimates	$1.645 \times \sqrt{(.740 \times p \times (100\ \ p))/A}$
All other estimates[2]	$1.645 \times \sqrt{(.465 \times p \times (100\ \ p))/A}$
1999 AHS-N Metropolitan Sample	
Chicago, IL	$1.645 \times \sqrt{(1.100 \times p \times (100\ \ p))/A}$
Detroit, MI	$1.645 \times \sqrt{(1.100 \times p \times (100\ \ p))/A}$
Los Angeles-Long Beach, CA	$1.645 \times \sqrt{(1.100 \times p \times (100\ \ p))/A}$
New York-Nassau-Suffolk-Newburgh, NY	$1.645 \times \sqrt{(2.350 \times p \times (100\ \ p))/A}$
Northern New Jersey	$1.645 \times \sqrt{(2.300 \times p \times (100\ \ p))/A}$
Philadelphia, PA-NJ	$1.645 \times \sqrt{(1.100 \times p \times (100\ \ p))/A}$

[1]These formulas are equivalent to $1.645 \times \sqrt{(p \times (1\ \ p))/n}$. For example, for all other estimates in the Baltimore, MD, metropolitan area, .27/A adjusts the data to the effective sample size.

[2]Some items (for example, characteristic of total housing units) may involve housing units from both the mobile home and nonmobile home universe. The formulas for all other estimates should be used for these items. The formulas for mobile home estimates should be used for items that only involve housing units from the mobile home universe.

Table BB. **How to Compute a 90-Percent Confidence Interval for a Median**

Steps for calculations	The formula	An example	Your data
How many total units is the median based on (in thousands, exclude "not reported" and "don't know")?	A	297.3	___
What are the end-points of the category the median is in?	X - Y	$600-699	___
What is the width of this category (in dollars, rooms, or whatever the item measures)?	W	$100	___
How many housing units are in this median category (in thousands)?	B	21.6	___
Then the error from sampling for the median is approximately:[1]	$\frac{K \times W \times \sqrt{A}}{B}$	$\frac{.426 \times 100 \times \sqrt{297.3}}{21.6} = \$34$	___
The 90-percent confidence interval for the median is:	median $\pm \frac{K \times W \times \sqrt{A}}{B}$	median ± $34	___

[1]Note: To obtain an appropriate value for K, multiply the **numerator** of the formula for computing the error from sampling for 50 percent by a factor of .01. Refer to the Percents section of this appendix for the appropriate formula for AHS-N. Refer to Table AA for the appropriate formula for AHS-MS and the AHS-National metropolitan areas. For example, for estimates consisting of only mobile homes in the Baltimore, MD, metropolitan area $k = .01 \times (1.645 \times \sqrt{.405 \times 50 \times 50}) = .523$ and for all other estimates in Baltimore, K = .427.

Table CC. **Calculation of the 90-Percent Confidence Interval for Medians**

In the following example, cost data are used to calculate the 90-percent confidence interval for medians (all numbers are in thousands):

		Cumulative number of housing units
Total housing units	321.6	
Less than $500	109.3	109.3
$500 to $599	24.7	134.0
$600 to $699	21.6	155.6
$700 to $799	28.9	184.5
$800 or more	112.8	297.3
Not reported	24.4	
Median	$668	

Item	Formula	Bottom limit		Top limit	
		Example	Your data	Example	Your data
How many total units is the median based on (in thousands, exclude "not reported" and "no cash rent")?	A	297.3			
Half the total, for the median (in thousands)	A/2	148.65			
Error from sampling for 50 percent of the base of this median (first line)[1]	$42.6/\sqrt{A}$	2.47			
Multiply this percentage error by .01 to turn it into a fraction and by total units to give the error in housing units	$.426\sqrt{A}$	7.35			
Bottom of error range (second line minus fourth line, in thousands)	B_{bottom}	*141.3			
Top of error range (second line plus fourth line, in thousands)	B_{top}			*156	
* Start adding up the housing units in the table, category by category, cumulatively from the beginning of the table, until you exceed the starred number above. What interval does the starred number fall in?		$600-699		$700-799	
How many housing units are in all the categories before this one (in thousands)?	C	134.0		155.6	
How many housing units are in this category (in thousands)?	D	21.6		28.9	
What is the bottom limit of this category (in dollars, rooms, or whatever the item measures)?	E	$600		$700	
What is the bottom limit of the next category (in dollars, rooms, etc)?	F	$700		$800	
Formula to calculate limits of confidence interval	$\frac{(B-C)}{D}(F-E)+E$	$\frac{(141.3-134.0)}{21.6}(100)+600$		$\frac{(156-155.6)}{28.9}(100)+700$	
Limits of confidence interval (in dollars, rooms, etc.)		$634		$701	

* Starting with the starred step, this worksheet is equivalent to interpolation, for those who are familiar with this term.

[1]Statistical note: This formula is based on the error from sampling for 50 percent (using the appropriate formula, $1.645 \times \sqrt{.405 \times 50 \times (100-50)/A} = 52.3/\sqrt{A}$ for medians involving estimates of only mobile homes in Baltimore, MD, metropolitan area. For medians involving all other estimates in the Baltimore, MD, metropolitan area, use $42.6/\sqrt{A}$. Refer to the Percents section of this appendix for the appropriate formula for AHS-N. Refer to Table AA for the appropriate formula for AHS-MS.